UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/806,466	03/23/2004	Shuichi Hirukawa	20455203200	1703

25227 7590 10/27/2008
MORRISON & FOERSTER LLP
1650 TYSONS BOULEVARD
SUITE 400
MCLEAN, VA 22102

EXAMINER	
SAYADIAN, HRAYR	

ART UNIT	PAPER NUMBER
2815	

MAIL DATE	DELIVERY MODE
10/27/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/806,466	Applicant(s) HIRUKAWA ET AL.	
	Examiner HRAYR A. SAYADIAN	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 June 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,4 and 6-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4 and 6-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/15/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED OFFICE ACTION

35 U.S.C. § 103 Rejections of the Claims

1. Claims 1, 3, 7, 9, 11, 13, 15, 17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over PGPUB U.S. 2003/0048825, for an application by "Hirukawa" in view of any of: Hirukawa; Hirukawa's admitted prior art Japanese Patent Document having Publication Number 03-064980 by Matsubara, assigned to Fuji [hereinafter "HAPA-1"]; Japanese Patent Application having Publication Number 11-274644, to Tatsumi et al., assigned to Sharp [hereinafter "AAPA-1"]; and Japanese Patent Application having Publication Number 11-112087, to Matsumoto, assigned to Sharp [hereinafter "Matsumoto]," further in view of U.S. Pat. No. 5,636,236 to "Tada." U.S. Pat. No. 6,563,850 to Matsumoto et al., which corresponds to AAPA-1 and Matsumoto, was cited in the 892 FORM provided with a previous Office Action.

With respect to claims 1, 3, 7, 9, 11, and 15:

Hirukawa discloses a semiconductor laser device (see FIG. 1 the growth of which is described by reference to FIGs. 2-4, see, for example, Column 3, ¶¶ [0056 and 0057]) in which, on an n-type GaAs substrate (Fig. 2, element 101, as described in ¶ [0057]), there are at least an n-type cladding layer (Fig. 2, element 103, as described in ¶ [0057]), a lower guide layer (Fig. 2, element 104, as described in ¶ [0057]), an InGaAsP quantum well active layer composed of one or a plurality of well layers and a plurality of barrier layers alternately disposed (Fig. 2, element 105, as described in ¶ [0057]), an upper guide layer (Fig. 2, element 106, as described in ¶ [0057]), and a p-type upper cladding layer (Fig. 2, element 107, as described in ¶ [0057]), that are stacked, wherein the quantum well active layer is stacked so that an n-side barrier layer is present on a side of the lower guide layer and a p-side barrier layer is present on a side of the upper-guide layer, the n-side barrier having thickness of 70Å or more (Fig. 2, element 105, as described in ¶ [0057], has an n-side barrier having 100 Å thickness), the upper and lower guide layers being AlGaAs with Al mole fraction greater than 0.2 (Fig. 2, elements 104 and 106, as described in ¶ [0057], have Al mole fraction of .35), the well layers having compressive

strain and the barrier layers having tensile strain (Fig. 2, element 105, as described in ¶ [0057], has the wells with compressive strain and the barriers with tensile strain), said semiconductor laser device having an oscillation wavelength of more than 760 nm and less than 800 nm (See, for example, Hirukawa, Abstract and Column 1, ¶ [0010]).

Hirukawa discloses using InGaAsP active layer to generate 780 micron radiation instead of AlGaAs to avoid Al caused limitations on higher output, higher reliability, and longer life. See, for example, paragraphs [0008] and [0015].

Hirukawa notes the difficulty in making AlGaAs active region laser diodes have higher output, higher reliability, and longer life because the Al in the AlGaAs active region oxidizes. See, for example, paragraph [0008]. Hirukawa proposes therefore using InGaAsP (which does not include Al, and therefore does not oxidize) as the active region. See, for example, paragraph [0015].

Hirukawa notes that in semiconductor laser devices including ridge-strips, "[g]enerally" forming the current blocking layers generates a hollow portion in the lateral face of the ridge-strip. See, for example, paragraph [0004]. Hirukawa recognizes that HAPA-1 discloses and motivates using a current blocking layer consisting of a solid layer (and therefore doing away with the hollow regions in the current blocking regions; see for example paragraph [0005] of Hirukawa) because the hollow regions have a lower refractive index and therefore current blocking layers including hollow regions make difficult producing single transverse mode oscillation.

Hirukawa recognizes that InGaAsP has lower index of refraction than AlGaAs. See, for example, paragraph [0015]. And Hirukawa therefore notes the additional benefit of using InGaAsP active layer, instead of AlGaAs active layer: The lowering of the differential in the index of refraction in devices including current blocking layers including hollow portions. See, for example, paragraph [0015], stating that using InGaAsP active layer in devices having hollow portions "generates acceptable difference of refractive index sufficient for stabilizing a single transverse mode oscillation."

Arguably, though, Hirukawa does not explicitly disclose a device having InGaAsP active layer and using a current blocking region consisting of a solid (hollow-less) layer. And Hirukawa discloses that "a hollow portion formed inside the first current

blocking layer saves an effort at preventing an overhang formed over the ridge stripe-shaped third cladding layer." See, for example, paragraph [0078] of Hirukawa.

However using solid (i.e., hollow-less) current blocking layers is notoriously well known in the art. See, for example, AAPA-1, Matsumoto disclosing solid (i.e., hollow-less) current blocking layers; and see, for example, Hirukawa and HAPA-1 disclosing and motivating using solid (i.e., hollow-less) current blocking layers.

Accordingly, to ease the production of single transverse mode oscillation in a ridge-striped semiconductor laser therefore it would have been obvious to modify the device Hirukawa discloses by eliminating the hollow portions and thus solving the problem of the hollow portions having a low refractive index, which cause difficulty in producing single transverse mode oscillation—this modification yielding solid (i.e., hollow-less) current blocking layers. Again, see, for example, paragraph [0005] of Hirukawa recognizing HAPA-1 discloses easing the production of single transverse mode oscillation in a ridge-striped semiconductor laser by eliminating the hollow portions in the current blocking layer.

Hirukawa does not disclose making the p-side barrier thickness smaller than the n-side barrier thickness.

However, in the active region of a laser diode, Tada discloses making the width of the p-side barrier be less than that for the width of an n-side barrier. See, for example, FIG. 12. And Tada motivates this modification to achieve uniform hole and electron carrier distribution. See, for example, Tada columns 4 and 6, lines 3-32 and 43-47, respectively. And Tada explicitly disclosers that "by achieving … uniform hole distribution … the threshold lasing current can be reduced, and the external differential quantum efficiency can be improved." Tada, column 4, lines 26-33.

Accordingly, it would have been obvious to modify the disclosure of Hirukawa as modified by Hirukawa, HAPA-1, AAPA-1, or Matsumoto, as motivated by Hirukawa and HAPA-1, to make the p-side barrier thickness smaller than the n-side barrier thickness to obtain uniform carrier distribution.

Hirukawa does not disclose making the p-side barrier less than 70Å. Instead the three barrier layers in Hirukawa are disclosed as having 100, 70, and 100 Å thicknesses, respectively.

Again, Tada however discloses and motivates reducing the barrier width in the active regions of MQW diode lasers. See, for example, FIG. 12. And Tada specifically discloses an embodiment wherein the n-side barrier width is 80Å and the p-side barrier width is 20Å for an InGaAsP active region MQW diode laser to obtain uniform carrier distribution. See Tada column 6, lines 42-47 describing the structure shown in FIG. 12.

Accordingly, it would have been obvious to modify the disclosure of Hirukawa as modified by Hirukawa, HAPA-1, AAPA-1, or Matsumoto, as motivated by Hirukawa and HAPA-1, to make the p-side barrier thickness less than 70Å to obtain uniform carrier distribution.

With respect to claims 13 and 17:

In Column 3, ¶¶ [0041] and [0042], Hirukawa discloses, quantities for well layer compressive strain and barrier layer tensile strain being less than 3.5%.

With respect to claim 19:

In Column 5, ¶ [0073], describing FIG. 7, Hirukawa discloses using device meeting the features and limitations of claim 1 in an optical disc unit.

2. Claims 4, 6, 8, 10, 12, 14, 16, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirukawa as modified by Hirukawa, HAPA-1, AAPA-1, or Matsumoto, as motivated by Hirukawa and HAPA-1, further in view of Tada, further in view of U.S. Pat. No. 6,127,691 to "Fukunaga" and U.S. Pat. No. 6,154,476 to "Nishiguchi."

With respect to claim 4, 6, 8, 10, 12, 14, 16, and 18:

Hirukawa (as modified above) discloses all of the features and limitations recited in claims 4, 6, 8, 10, 12, 14, 16, and 18 except for making the GaAs substrate p-type, as recited in independent claim 4.

Fukunaga however explicitly discloses that similar structures can be grown from/on p-type GaAs substrate. See, for example, Fukunaga column 6, lines 12-19.

Additionally, Nishiguchi discloses using a p-type GaAs substrate to grow laser diodes to allow using/integrating the laser diode with pnp transistors (which generally have higher operation speed than npn transistors) as the driving IC transistor. See, for example, Nishiguchi, column 1, lines 24-32, motivating the use of p-GaAs as the substrate for this specific motivation.

Accordingly, it would have been obvious to modify the disclosure of Hirukawa as modified by Hirukawa, HAPA-1, AAPA-1, or Matsumoto, as motivated by Hirukawa and HAPA-1, by using p-GaAs substrate instead of n-GaAs substrate to allow the easy integration with pnp transistors.

Response to Applicant's Arguments

3. Applicants' arguments have been considered but are found unconvincing.

The Reply explicitly recognizes that Hirukawa discloses the barrier layers being 100 angstroms (see, for example, the first sentence of the first full paragraph on page 6 of the Reply). The Reply nevertheless contends that Hirukawa fails to disclose the barrier layer being more than 70 angstroms (see, for example, the second sentence of the first full paragraph on page 6 of the Reply). Clearly, at least, the Reply's explicit recognition contradicts the Reply's contention.

The Reply explicitly recognizes that Tada discloses <u>and</u> motivates making the hole-rich barriers thinner (see, for example, the first full paragraph on page 7 of the Reply, explicitly citing Tada, column 6, lines 43-45). The Reply nevertheless contends that Tada fails to disclose the variation in the thickness of the barriers. This contention however fails to address the explicitly recognized and cited segment of Tada explicitly being directed to FIG. 12, which explicitly shows the p-side barriers having thinner thickness than the n-side barriers.

The Reply explicitly recognizes that Tada discloses the achieving of uniform carrier distribution by using thinner hole-rich barriers (see, for example, the last paragraph on page 6 and the first paragraph on page 7 of the Reply citing Tada, column 4, lines 20-26). The Reply nevertheless contends that one of ordinary skill in the art would still not have been motivated to

modify Hirukawa to make the barriers on the hole-rich side thinner than those on the electron-rich side. This contention however fails to recognize that Tada explicitly discloses (in the sentence immediately following the sentence the Reply cites in Tada) that achieving uniform carrier distribution results in "the threshold lasing current [being] reduced, and the external differential quantum efficiency [being] improved." See, for example, Tada, column 3, lines 26-32, cited in the previous Office Actions, but not addressed by the Reply.

Examiner additionally notes that the physics motivation behind Tada disclosing using thinner p-side barriers is the same as that disclosed in the present application.

Specifically, Tada explicitly discloses that " it is possible to equalize the hole distribution by intentionally making a thickness of a barrier layer close to a quantum well layer, which contains a large number of holes, be thin and positively using the tunneling effect," which explicitly discloses increasing he injection of the holes into the well. See, for example, Tada, column 4, lines 24-26; as cited by the Reply. And this application explicitly discloses "[i]n one embodiment of the present invention, the p-side barrier layer has a smaller thickness than that of the n-side barrier layer. According to the embodiment, tunneling of holes through the p-side barrier layer is facilitated, so that the holes are easily injected into the active region." See, for example, paragraph [0017] of the PGPUB corresponding to this application.

Accordingly, not only Tada discloses and motivates making the p-side barriers thinner than n-side barriers, Tada motivates this disclosure for the same reason as in this application.

Additional Prior Art of Record

4. Japanese Patent Document having Publication Number 07-297481 for inventors Hiroyama Ryoji, et al., assigned to Sanyo Electric Co., cited in the 7/15/2008 IDS by Applicant of this application, also discloses using p-side barriers that are thinner than n-side barriers to increase concentration of injected holes.

CONCLUSION

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS OFFICE ACTION IS MADE FINAL**. See M.P.E.P. § 706.07(a).

A shortened statutory period for reply to this Office Action is set to expire **THREE MONTHS** from the mailing date of this Office Action. Applicant is reminded of the extension of time policy as set forth in 37 CFR § 1.136(a).

If a first reply is filed within TWO MONTHS of the mailing date of this Office Action and the advisory Office Action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory Office Action is mailed, and any extension fee pursuant to 37 CFR § 1.136(a) will be calculated from the mailing date of the advisory Office Action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this Office Action.

Any inquiry concerning this communication or earlier communications from an Examiner should be directed to Examiner Hrayr A. Sayadian, at (571) 272-7779, on Monday through Friday, 7:30 am – 4:00 pm ET.

If attempts to reach Mr. Sayadian by telephone are unsuccessful, his supervisor, Supervisory Primary Examiner Kenneth Parker, can be reached at (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available only through Private PAIR. For more information about the PAIR system, see http://pair-direct.uspto.gov. The Electronic Business Center (EBC) at 866-217-9197 (toll-free) may answer questions on how to access the Private PAIR system.

HAS

/Kenneth A Parker/

Supervisory Patent Examiner, Art Unit 2815